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Lethality, Survivability, Mobility and Sustainment for America's Army

M9 Pistol Analysis and Modifications

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Objective Si

- Theoretical Study
  - Modifications to Current System
  - Upgrades to Current System
- Address long term M9 life issues
- Investigate Heat stress cycle failures

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Modifications to Current M9 Pistol

- Reduce Stress Concentrations
- Increase receiver life – cost concerns

Upgrades to Current System

- Picatinny Rail
- Lower wear characteristics

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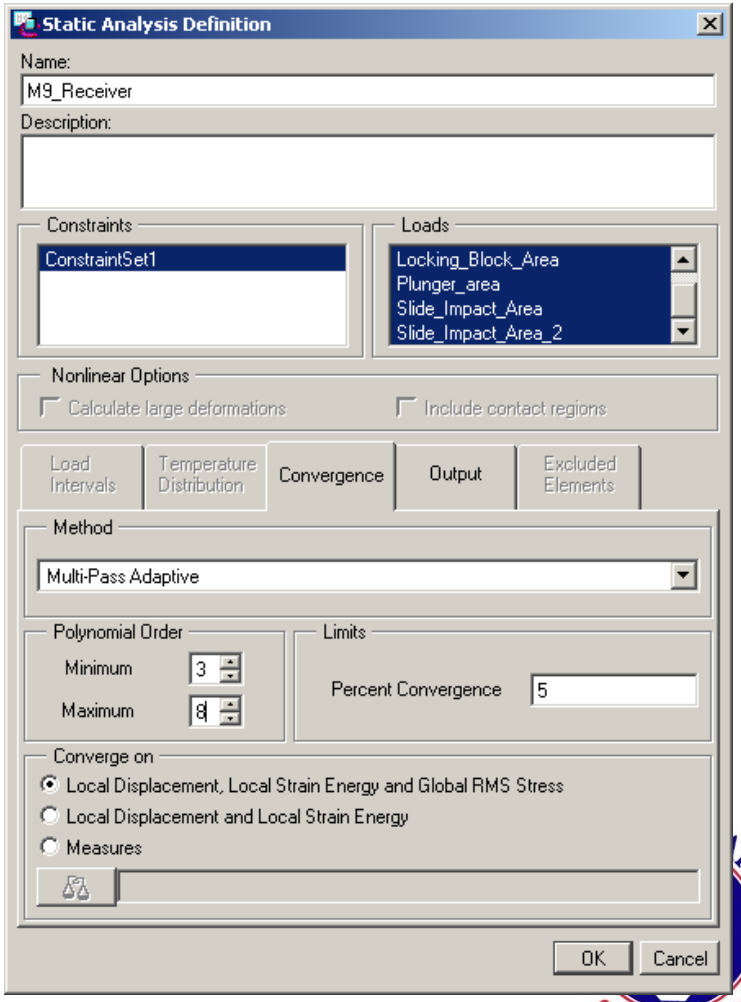
Finite Element Analysis Procedure



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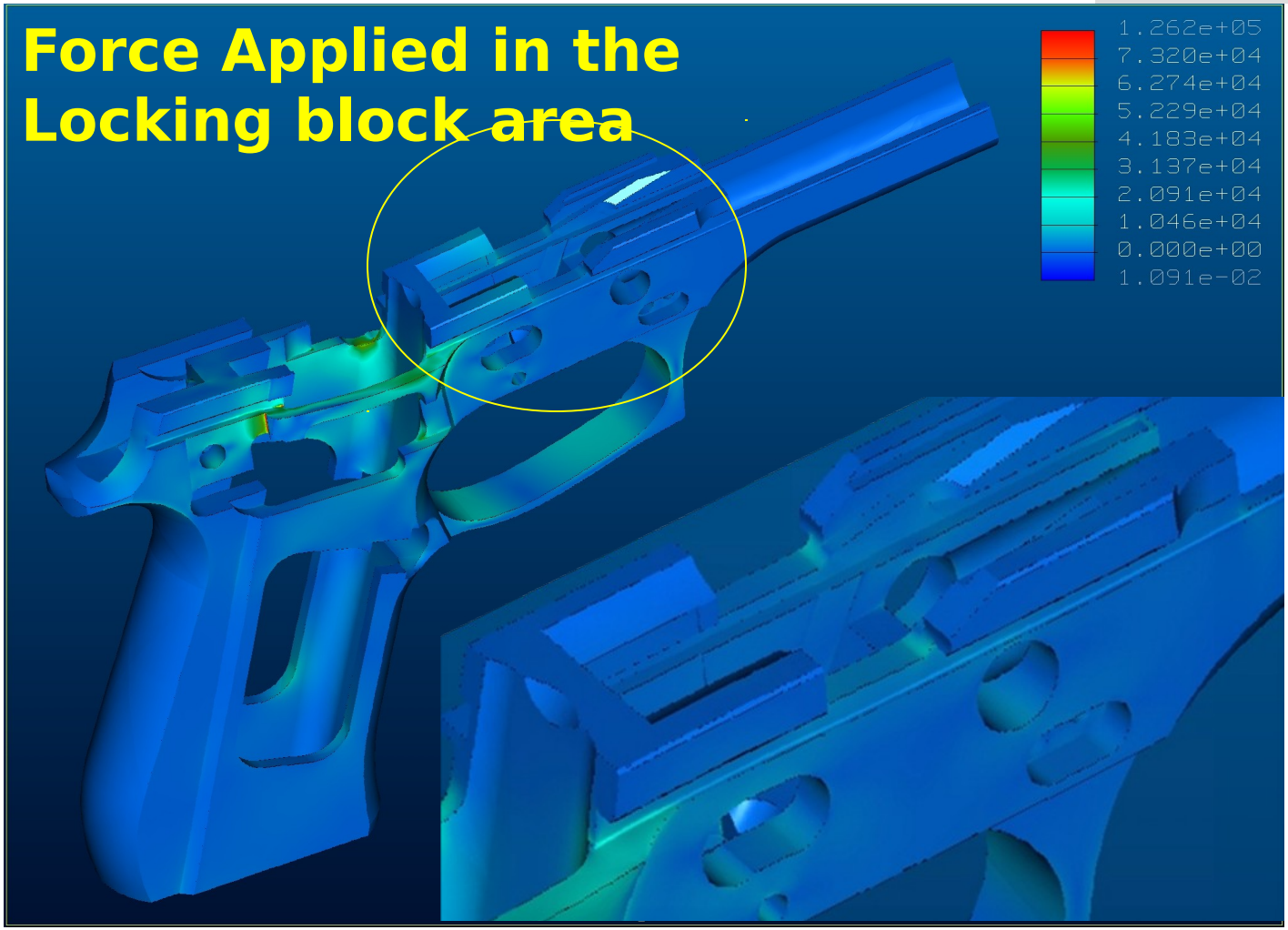
Force Applied in the Locking block area



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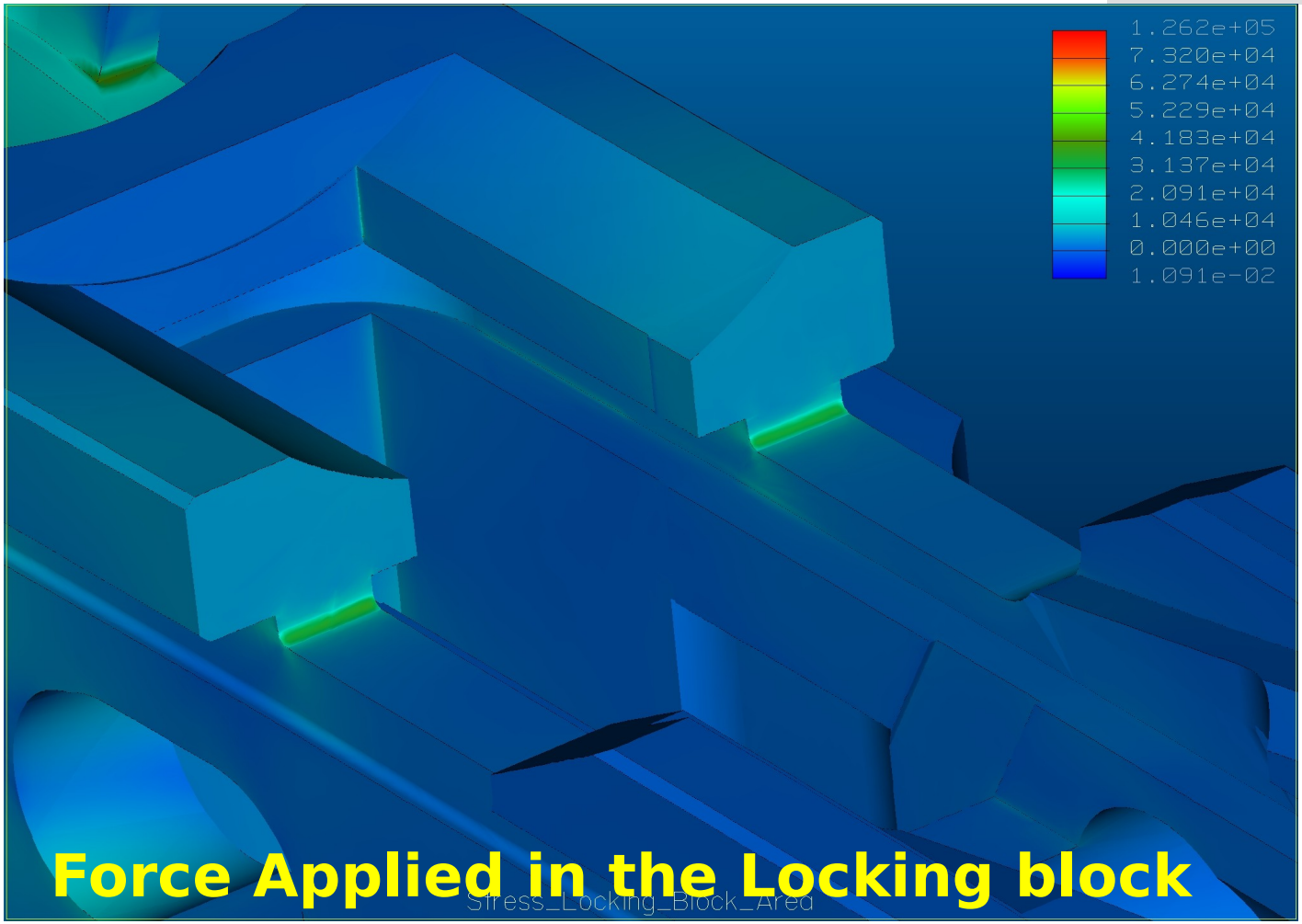

Force Applied in the Locking block area

Stress_Locking_Block_Ared

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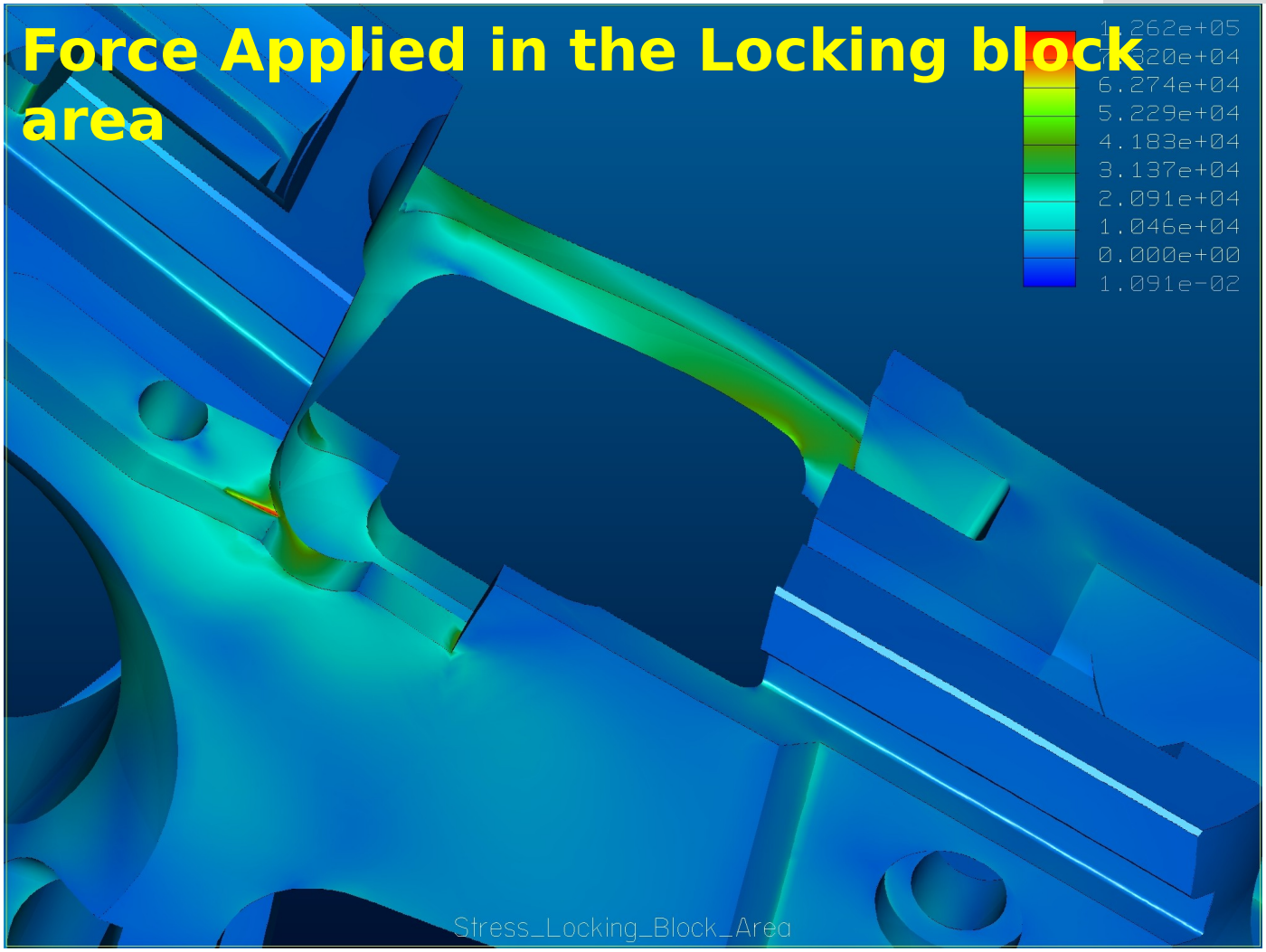
Force Applied in the Locking block area



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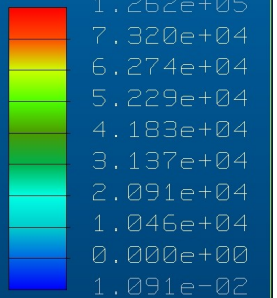
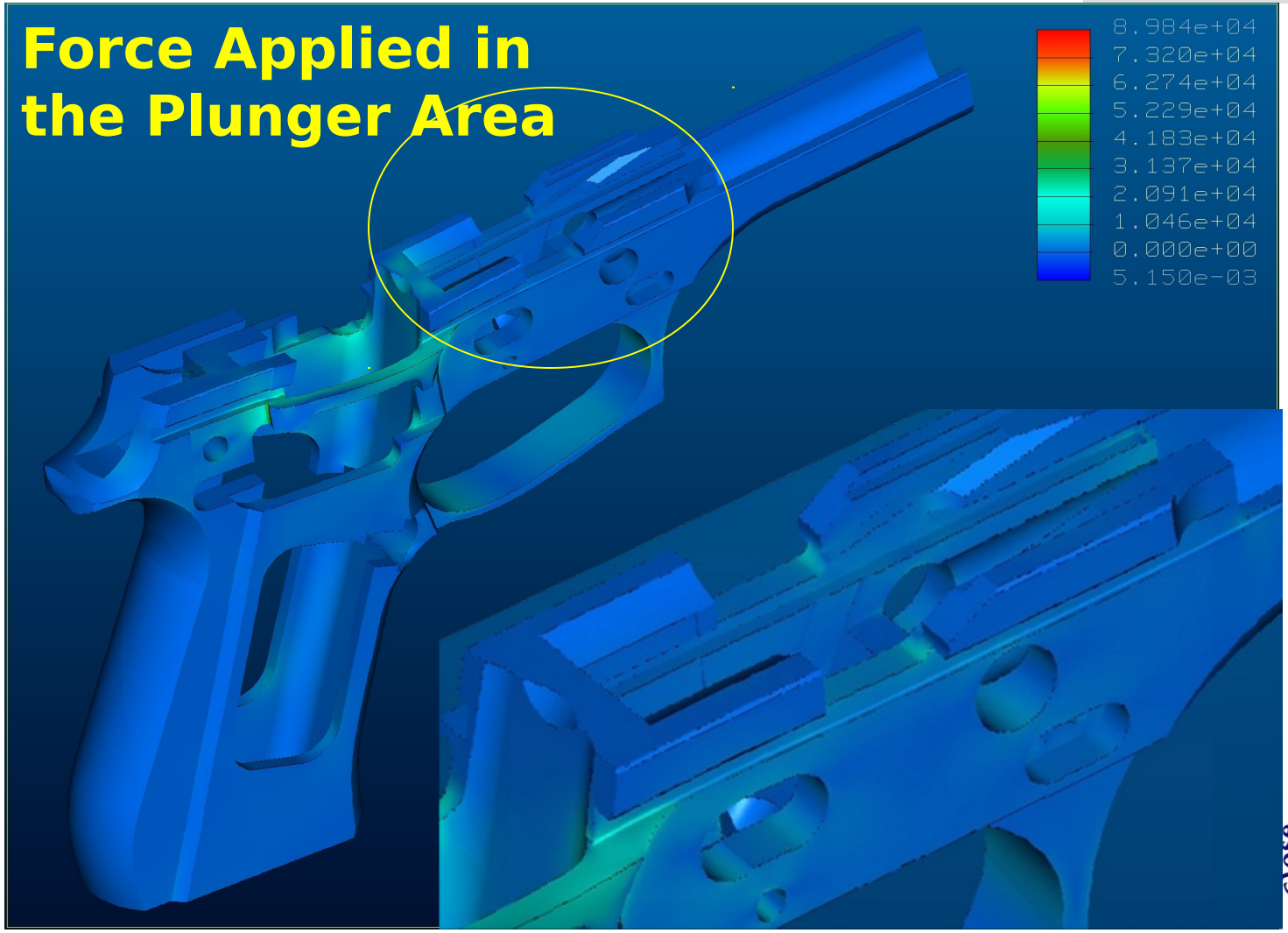
Force Applied in the Locking block area



Stress_Locking_Block_Area

Force Applied in the Plunger Area



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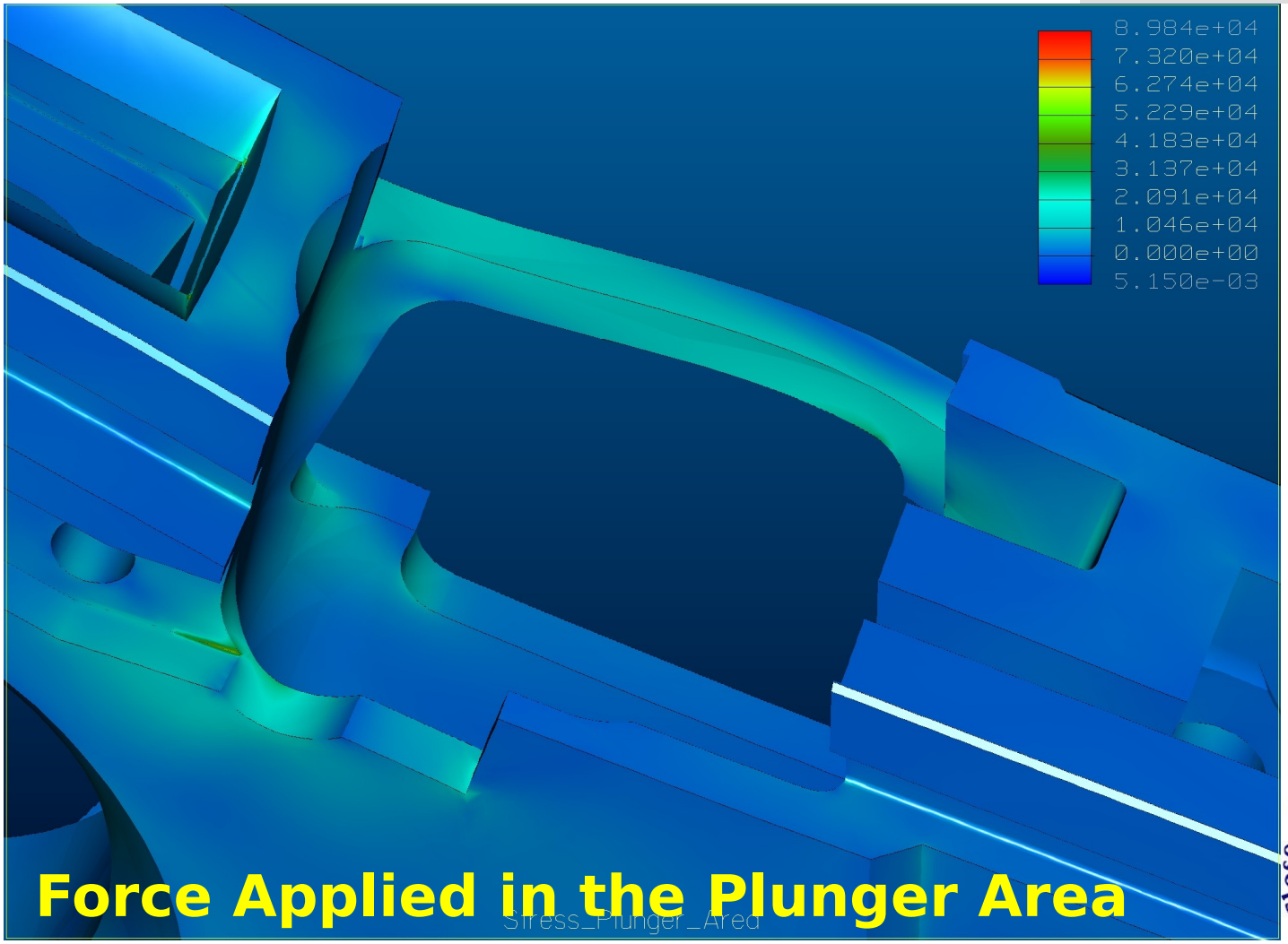
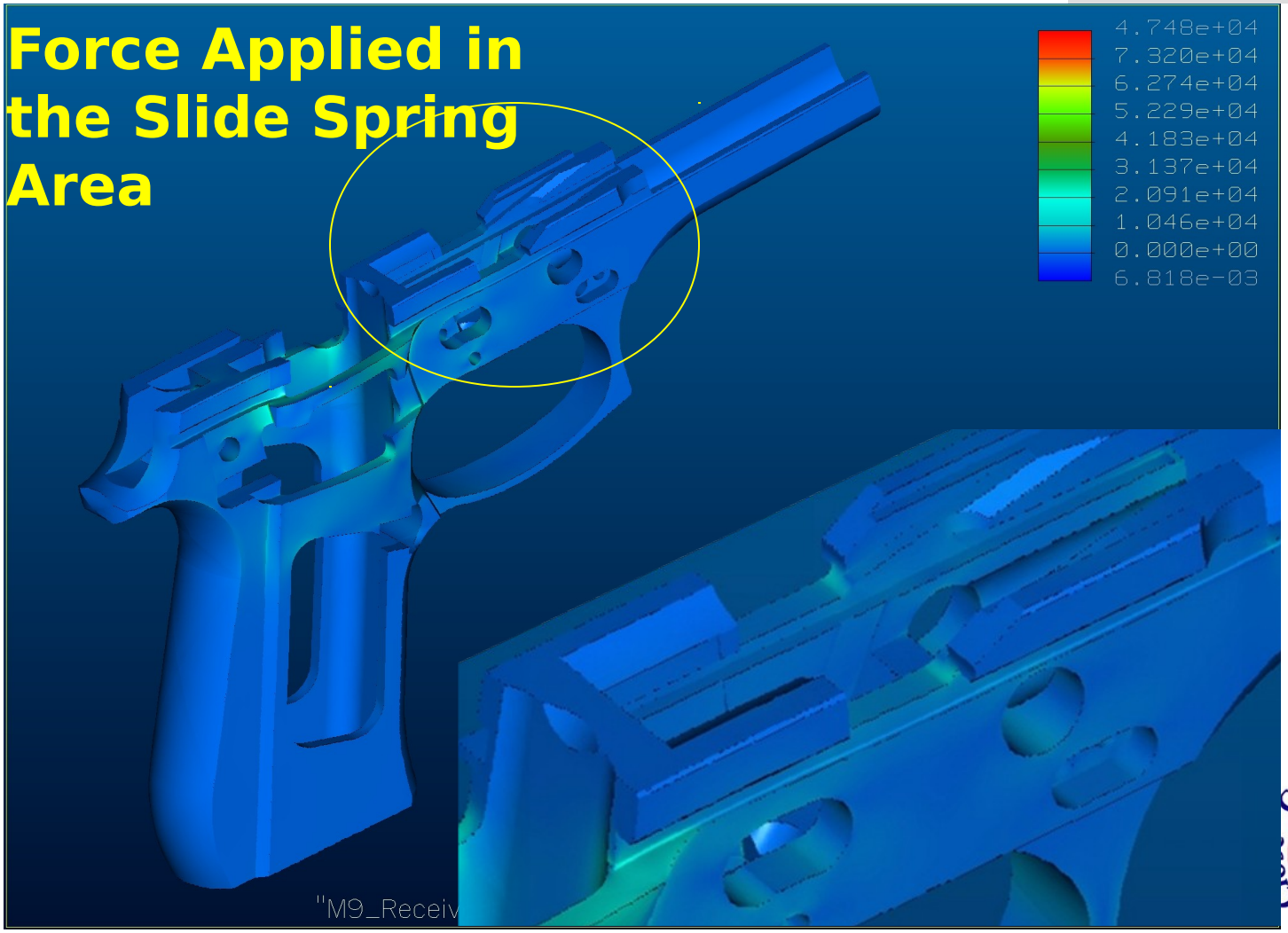


Force Applied in the Plunger Area

Stress_Plunger_Area

Force Applied in the Slide Spring Area



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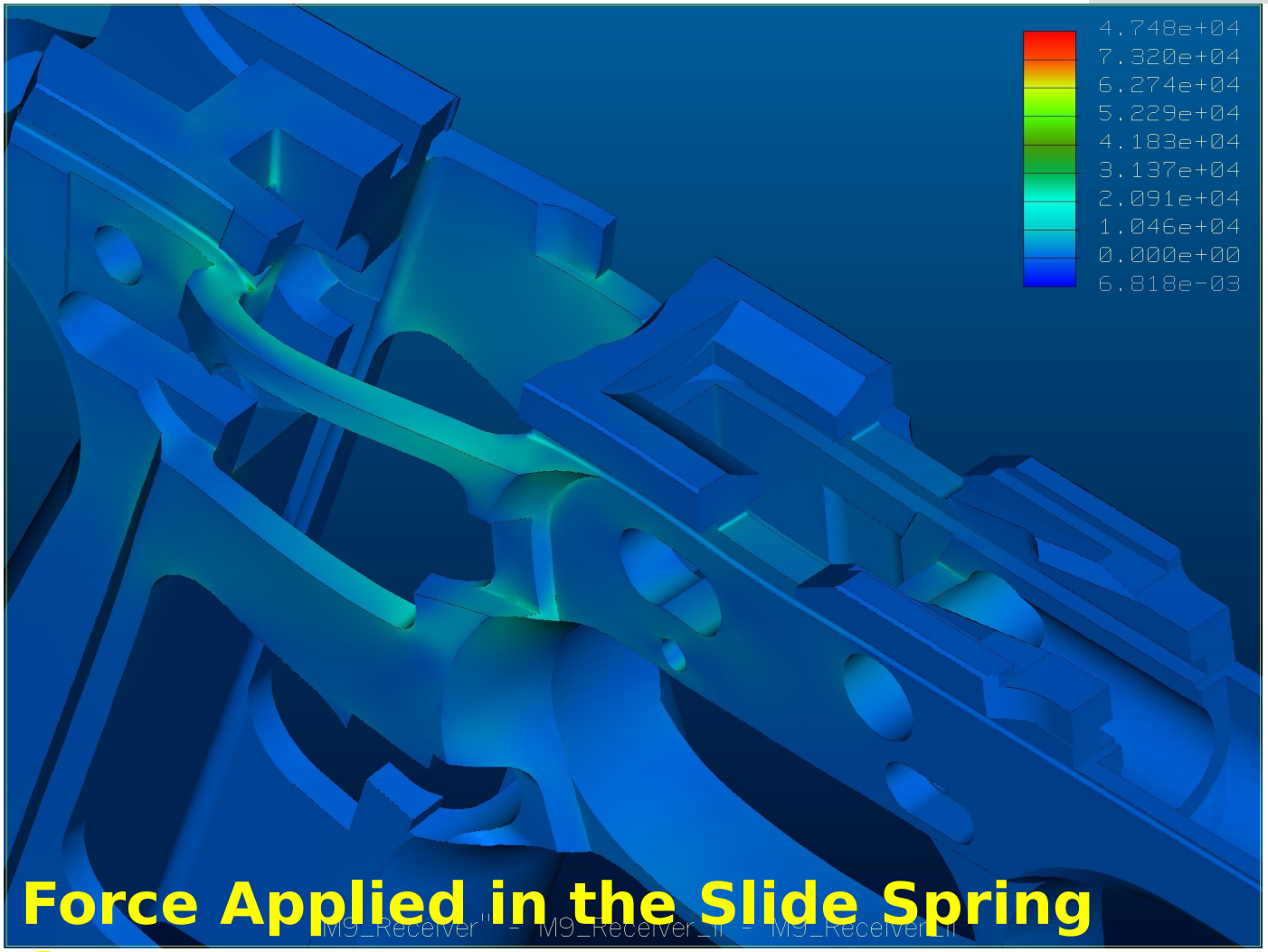

Force Applied in the Slide Spring Area

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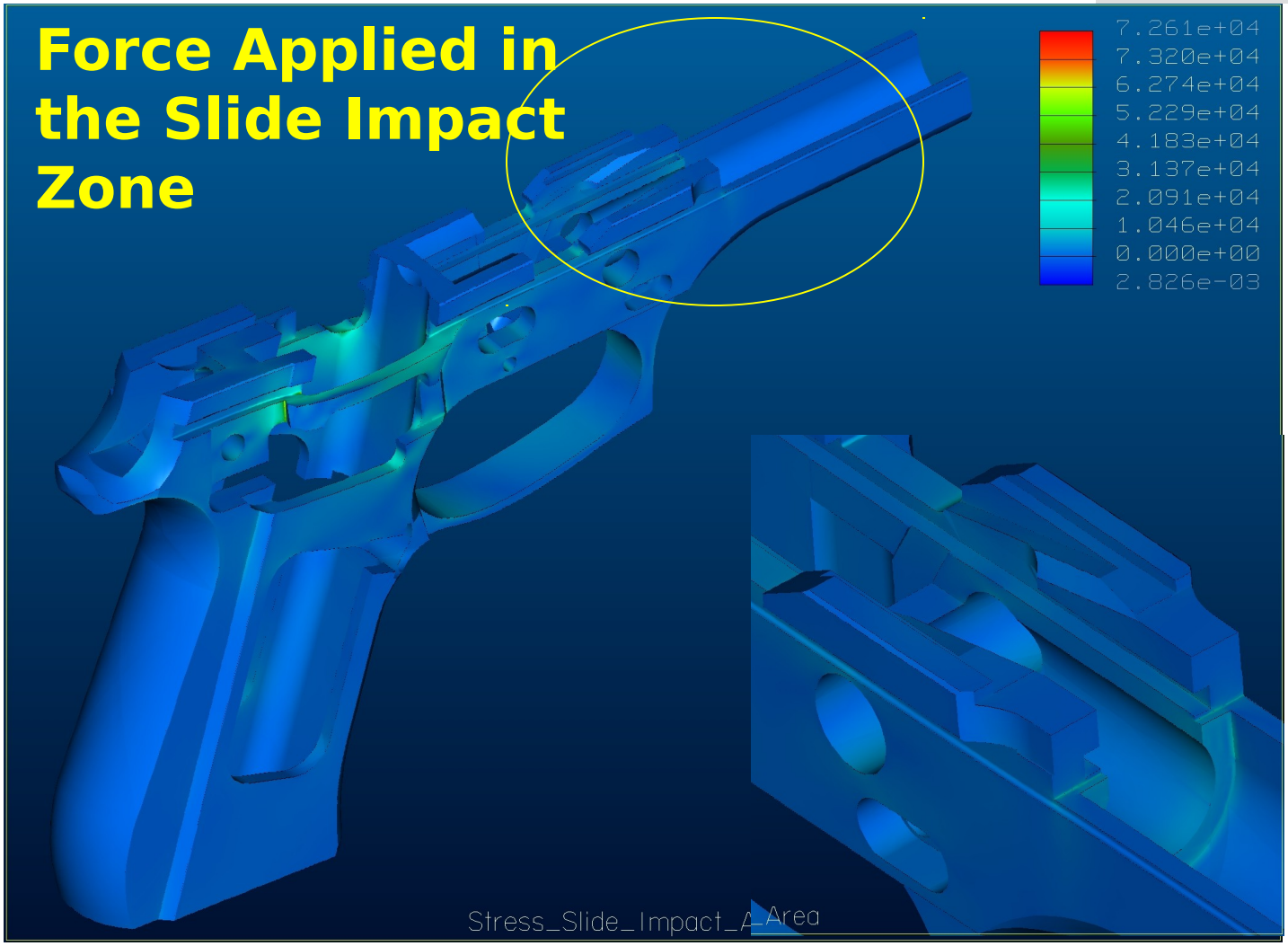
Force Applied in the Slide Impact Zone



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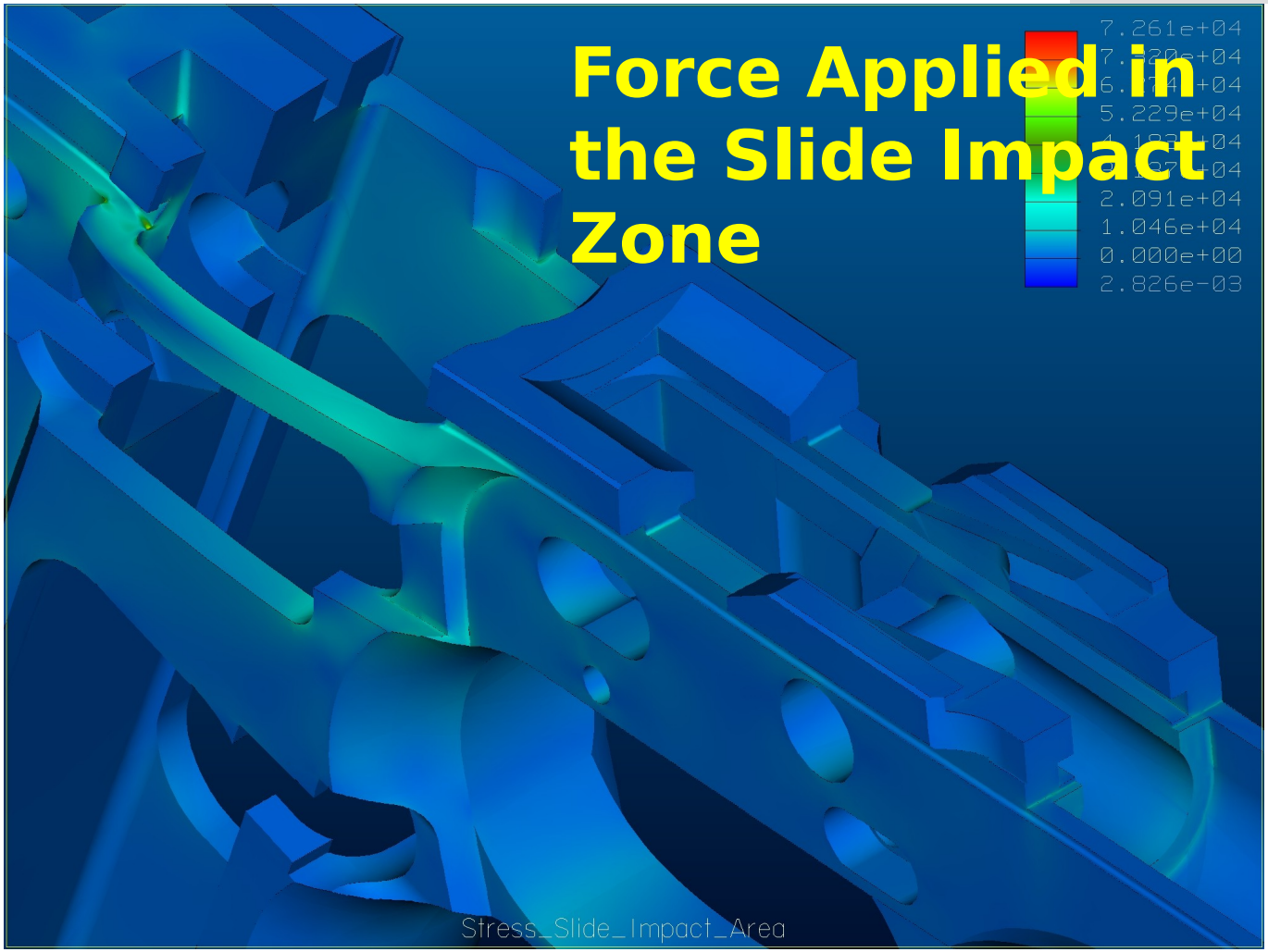
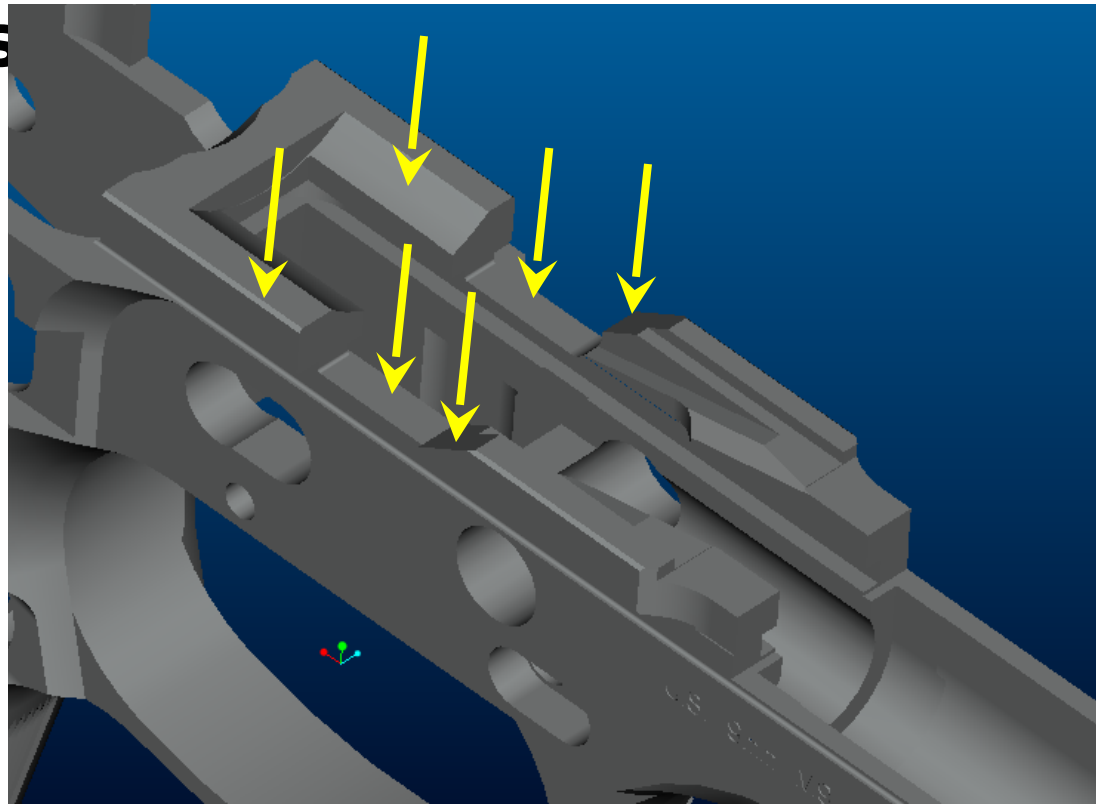
Force Applied in the Slide Impact Zone

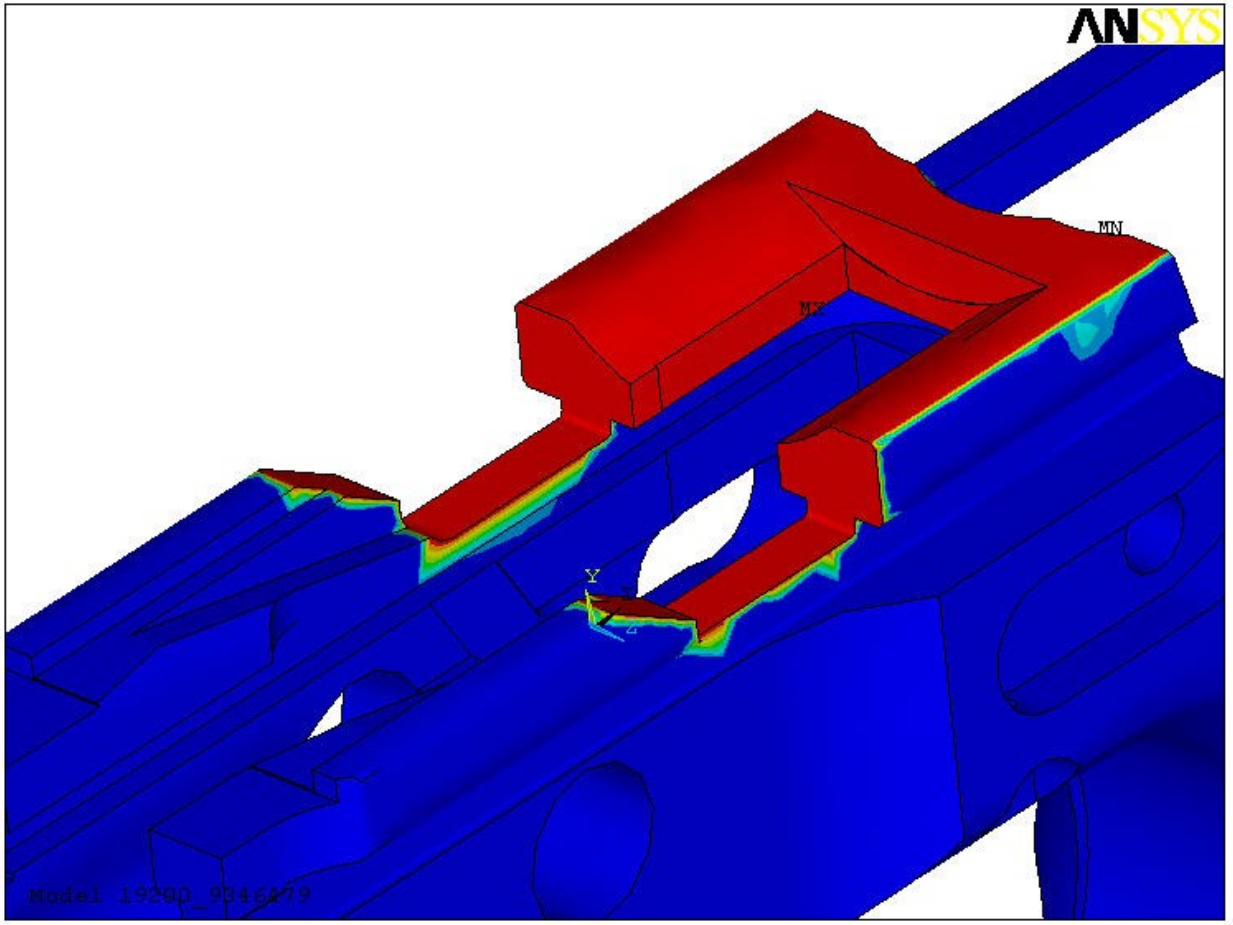


Transient Heat

FEA 350 degree Fahrenheit trans



Transient Heat FEA Results

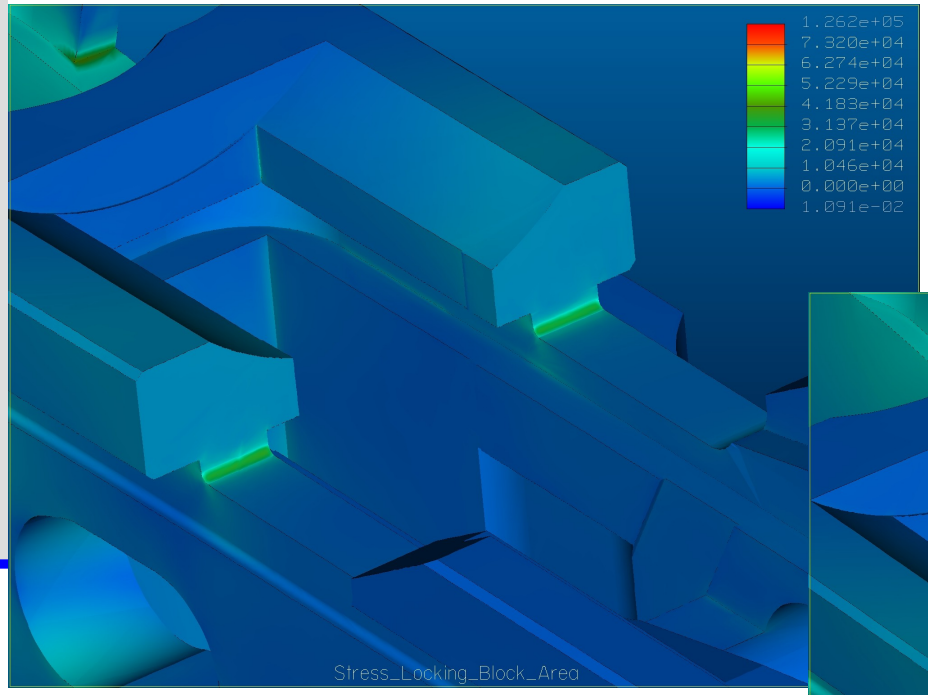


Modifications to Current Receiver

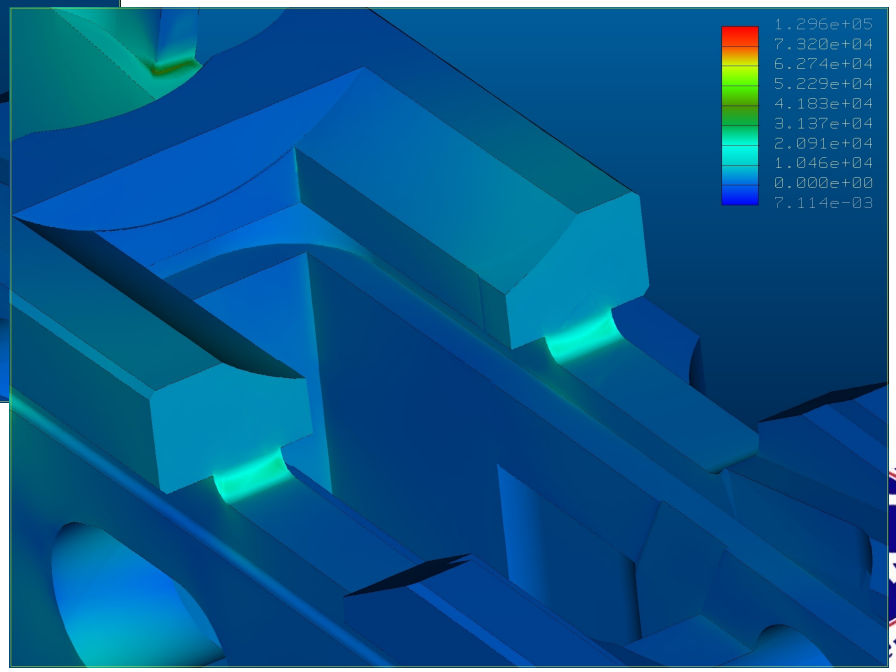
- Reduce stress concentrations in Locking Block area by increasing radius from .3 mm to .8 mm - decreases stress riser by a factor of 2

- Ensure proper heat treatment throughout the life of the parts

Modifications to Current Receiver



40 ksi stress at locking block radius



21 ksi stress at locking block radius

Upgrades to Current M9 Pistol

- MIL-STD-1913 Picatinny Rail
  - Commercial Solutions were deemed marginally acceptable for M9 and not acceptable for the M11
- Improved coating
  - Increase expensive part life
  - Keep all parts in the system longer

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Picatinny Rail

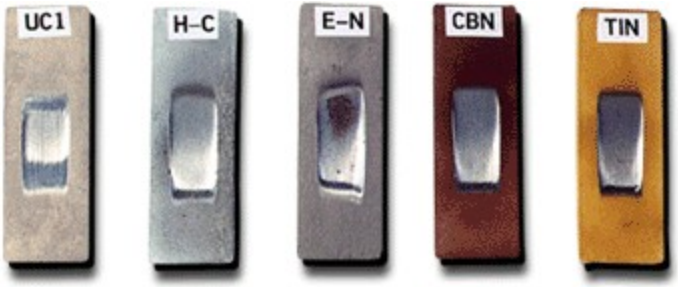
New CG
Original CG

Wear and Residue Reduction

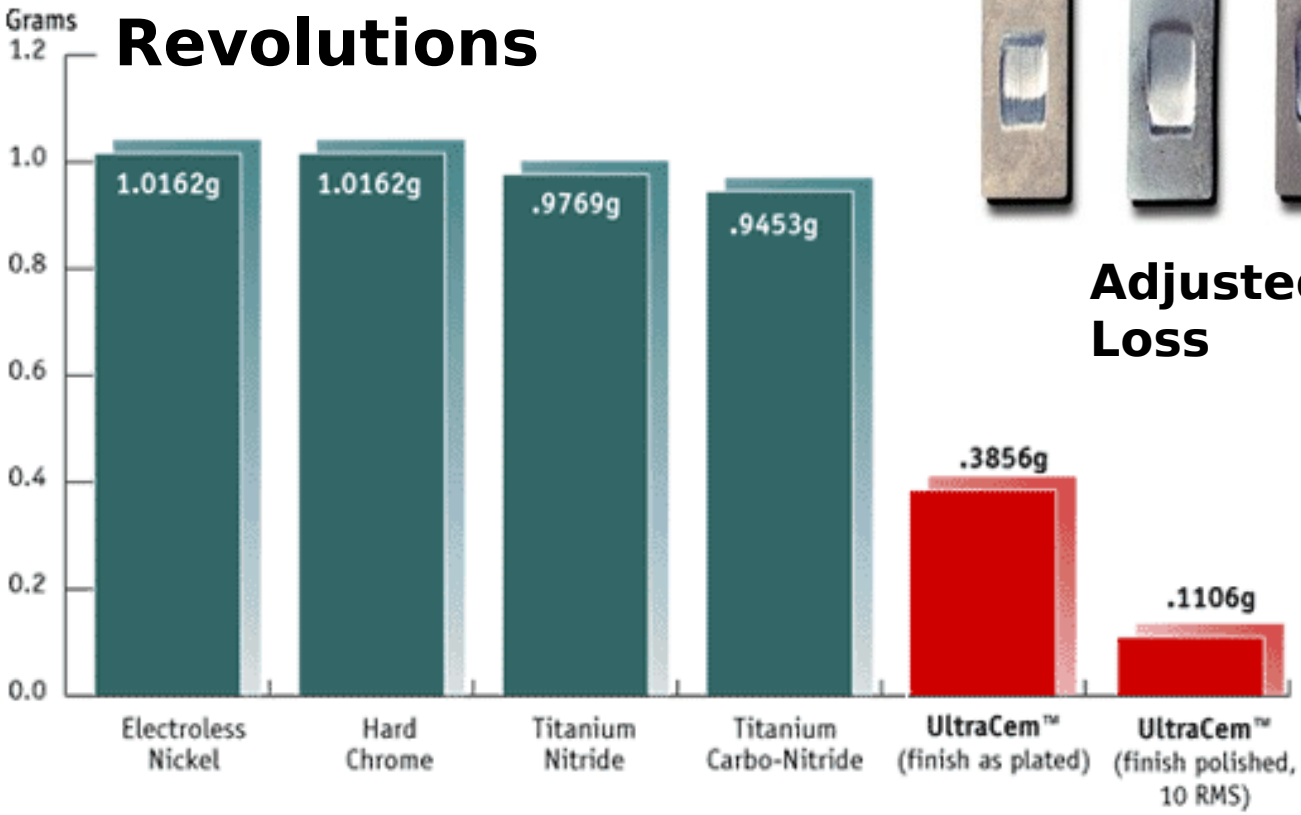
UCT Defense's UltraCem

- Columnar growth Coating
- Coefficient of Friction
  - **UltraCem™: .08**
  - **Hard Chrome: 1.3 - 1.35**
- Gunpowder residue doesn't stick to weapon parts
  - Residue and coating does not bond chemically
- Tested by the Army Marksmanship Unit

UltraCem® Abrasion Resistance Comparisons ASTM-G65 Abrasive San Revolutions



Adjusted Mass Loss



ASTM-G65 Abrasive Sand Test

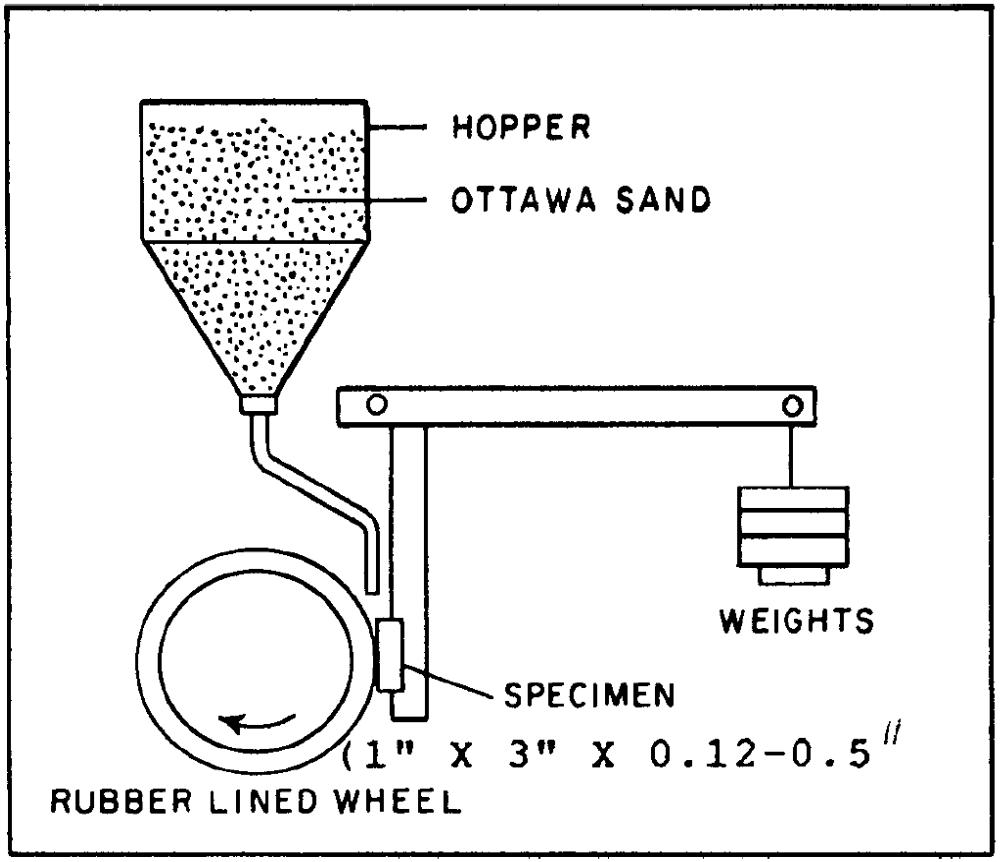


FIG. 1 Schematic Diagram of Test Apparatus

Future Work

- Live fire testing of the UltraCem® product
- Dynamic Simulation Analysis Software
  - Accurately evaluate part velocities and impact forces
  - Generate a robust and accurate 3D dynamic model

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Software Evaluation:

- MSC Corp.
  - ADAMS software package
  - Virtual Nastran 4d
- LMS Corp
  - Virtual.Lab package
- Parametric Technology Center
  - MDO/MDX Package

Future Work

- Evaluating criteria for the mechanical simulation packages:
  - Compatibility with Pro-Engineer
  - Overall Cost / Cost Flexibility; i.e. leasing, etc.
  - Design of Experiments Capable
  - Industry/Technical Support
  - Software Complexity
  - Speed of Iterations
  - Ease of use

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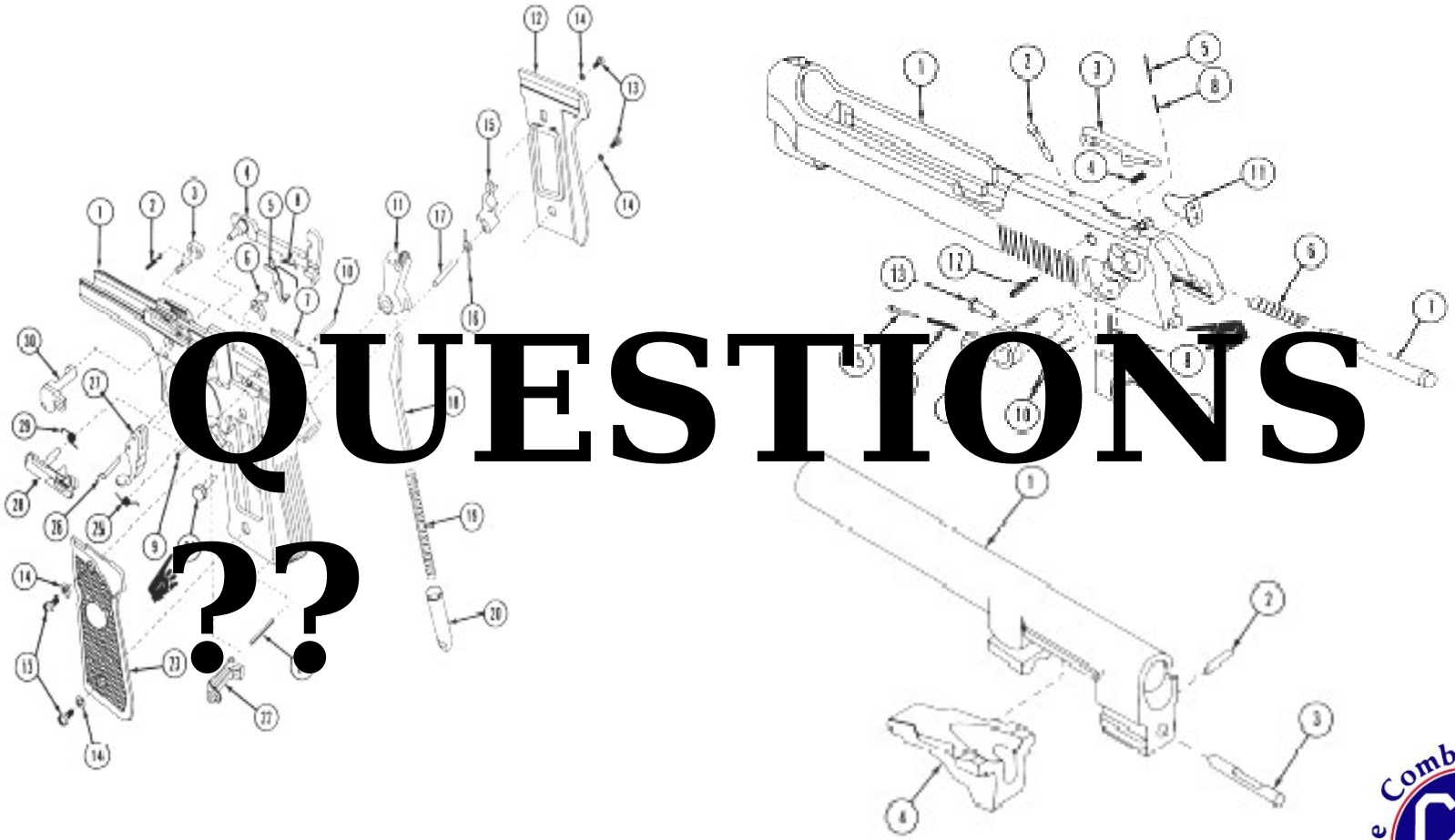

QUESTIONS ??

Close Combat Armaments Center